

Demand for dental care reflects people's want or desire for dental care and willingness to pay at market prices. Demand is expressed through the use of dental services and hence can be measured in dental visits made and services received in a year. This report provides information on the change in demand for dental care among Australians over the period 1979 to 1995. It also presents information on the projected demand for dental care through to 2010. This information is presented so as to understand fundamental changes occurring in dentistry.

Data sources

This report uses population level data on dentate (some natural teeth) and edentulous (no natural teeth) persons and dental visits collected across four social surveys:

- the Australian Bureau of Statistics Special Supplementary Survey of Sight, Hearing and Dental Health 1979 (ABS SSS1, 1979) (ABS, 1980);

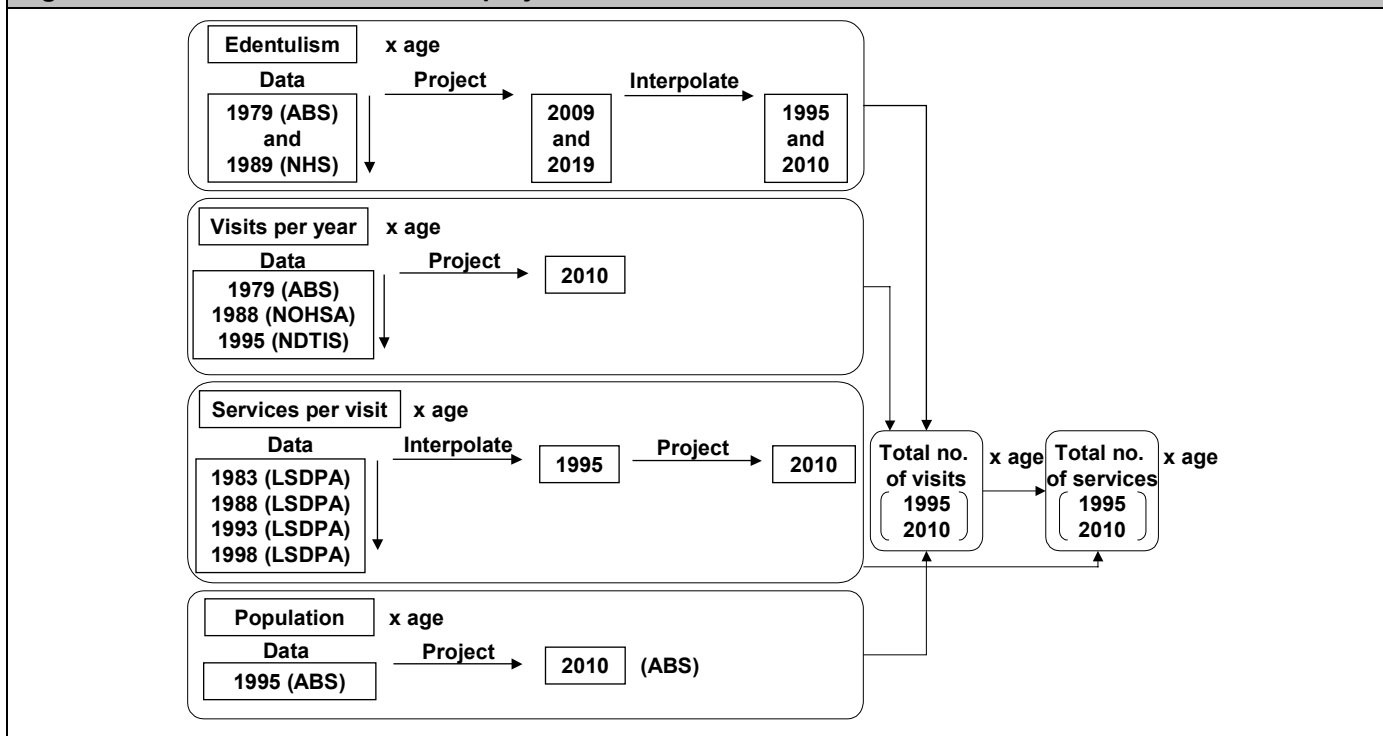
- the National Oral Health Survey of Australia 1987/88 (NOHSA, 1988) (Barnard, 1993);
- the National Health Survey 1989 (NHS, 1989) (ABS, 1991); and
- the combined National Dental Telephone Interview Surveys of 1994, 1995 and 1996 (NDTIS, 1995) (Brennan et al., 1997).

In addition, data on services received at dental visits collected in the Longitudinal Study of Dentist Practice Activity (LSDPA) in 1983, 1988, 1993 and 1998 are applied to convert dental visits to services (Brennan and Spencer, 2002).

Finally, in order to estimate the Australian population's demand for visits or services, the Australian Bureau of Statistics Population Projections, Series K, have been used through to 2010 (ABS, 2000).

Figure 1 provides an outline of the data available and their use to produce estimates for 1995 and projections to 2010 for edentulism, visits per year, services per visit and the product of these estimates and projections when multiplied by population data, as demand for visits and services in Australia.

Figure 1: Data used to estimate and project demand for dental care



Subgroups of the Australian population

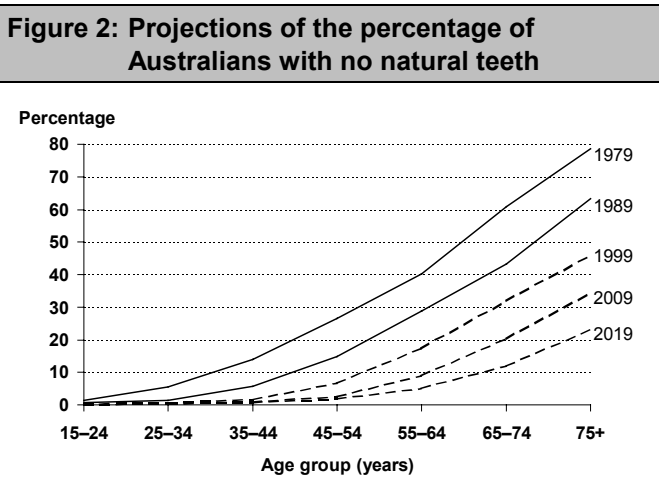
The demand for dental visits and services is dramatically different between dentate and edentulous Australians. In examining demand for dental visits, the population has been divided into those who were dentate and those who were edentulous for 10 separate age groups.

The ABS SSS1 1979 and the NHS 1989 provide data on dentate adults a decade apart. Table 1 presents the percentage of dentate and edentulous persons in 1979 and 1989 by the 10 age groups.

Age	Year			
	1979		1989	
	Dentate	Edentulous	Dentate	Edentulous
0-4, 5-11, 12-17	100.0	0.0	100.0	0.0
18-24	98.7	1.3	99.4	0.6
25-34	94.6	5.4	98.6	1.4
35-44	86.0	14.0	94.3	5.7
45-54	73.5	26.5	85.1	14.9
55-64	59.8	40.2	71.1	28.9
65-74	39.3	60.7	56.8	43.2
75+	21.4	78.6	36.6	63.4
Total (weighted)	84.6	15.4	89.2	10.8

Sources: ABS SSS1 1979; NHS 1989

The increase in the percentage who are edentulous, as an age group moves through the 10-year interval, can be used as a constant increment for future age groups moving through similar intervals. This synthetic cohort approach can be used to project the percentage of edentulous adults through to 1999, 2009 and 2019 (Figure 2).



Projection of the percentage edentulous is then used to interpolate the percentage dentate in 1995 and 2010, which are used later in the projections of demand.

Dental visits per year

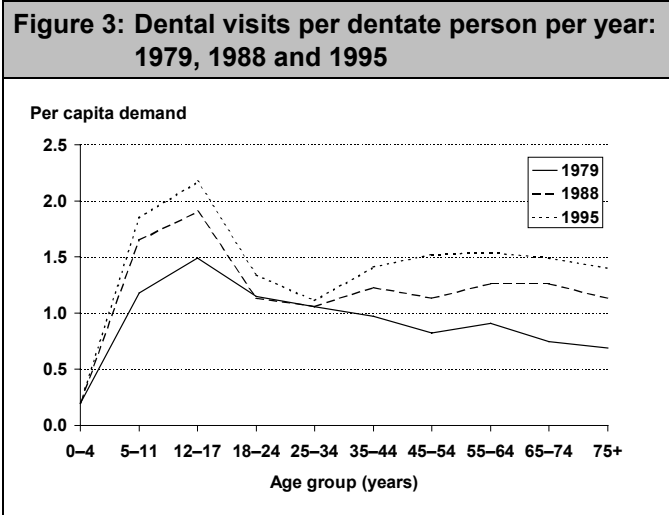
Dental visits among edentulous adults increased across ABS SSS1 1979, NOHSA 1988 and NDTIS 1995 (0.30, 0.35, 0.48 visits per person per year). Estimates for individual age groups are based on low numbers and lack stability. Therefore, dental visits per person per year for the whole edentulous population was applied to each of the age groups.

Dental visits among dentate persons has risen from 0.99 visits per year in 1979 to 1.50 visits per year in 1995. Table 2 presents the dental visits for the 10 age groups for 1979, 1988 and 1995.

Age	Year		
	1979	1988	1995
0-4	0.20	0.20	0.20
5-11	1.18	1.65	1.85
12-17	1.49	1.90	2.17
18-24	1.15	1.13	1.34
25-34	1.06	1.06	1.11
35-44	0.97	1.23	1.41
45-54	0.82	1.13	1.52
55-64	0.91	1.26	1.54
65-74	0.75	1.26	1.49
75+	0.69	1.13	1.40
Total (weighted)	0.99	1.32	1.50

Sources: ABS SSS1 1979; NOHSA 1988; NDTIS 1995

These data are presented graphically in Figure 3.



Several aspects of the change in demand for dental visits among the dentate are illustrated:

- demand for dental visits has increased particularly among children and adults 35-44 years old and above;
- while demand once showed a steady decline with age, in 1995 it showed a more complex pattern of a peak among adolescents (12-17-year-olds), a

trough among young adults (18–24, 25–34), then a high plateau among adults; and

- the demand for dental visits across dentate adult and older adult age groups is stable.

Change in the number of services per dental visit

Change in the number of dental services per visit can be followed from the LSDPA. The LSDPA collected data from representative samples of dentists in 1983, 1988, 1993 and 1998. The predominant group of dentists in the study is private general practice dentists. Table 3 presents the number of dental services per dental visit for private general practice dentists by the 10 age groups at each of the four times.

These data are based on all visits, including visits by edentulous persons. However, visits by edentulous persons comprise only 2% of all visits in 1998.

Age	Year			
	1983	1988	1993	1998
0–4	1.22	1.35	1.45	1.33
5–11	1.64	1.60	1.73	1.75
12–17	1.73	1.65	1.94	2.03
18–24	1.75	1.81	2.08	2.08
25–34	1.76	1.82	2.09	2.16
35–44	1.85	1.90	2.13	2.23
45–54	1.61	1.70	2.06	2.19
55–64	1.73	1.78	2.10	1.94
65–74	1.53	1.75	1.83	2.02
75+	1.74	1.78	1.86	2.00
Total (weighted)	1.72	1.78	2.02	2.09

Source: LSDPA

The total number of dental services provided per visit increased from 1983 to 1998. In the younger age groups, the number of services per dental visit was generally higher in 1998 than in 1983, but there was not always of a steady increase. For most adult age groups over 25–34 years old, the number of dental services per visit showed a more consistent increase across the time period.

Change in the mix of services per dental visit

The mix of services provided at each dental visit has also changed across the time period. A convenient way of representing the changing mix of services provided per dental visit is to use the Australian Dental Association's Schedule of Dental Services classification of 10 main service areas. These areas and the change in the mean number provided per dental visit over the

time period 1983 to 1998 for private general practice dentists are presented in Table 4.

Area	Year			
	1983	1988	1993	1998
Diagnostic	0.49	0.49	0.60	0.62
Preventive	0.27	0.30	0.34	0.37
Periodontic	0.01	0.02	0.02	0.02
Oral Surgery	0.09	0.09	0.09	0.08
Endodontic	0.06	0.06	0.11	0.14
Restorative	0.61	0.60	0.63	0.62
Crown & Bridge	0.03	0.06	0.07	0.07
Prosthodontic	0.11	0.09	0.10	0.11
Orthodontic	0.01	0.02	0.02	0.01
General Misc.	0.04	0.05	0.05	0.04
Total (weighted)	1.72	1.78	2.02	2.09

Source: LSDPA

Over the 15-year period, there has been an increase in Diagnostic, Preventive and Endodontic services, while Crown and Bridge services initially increased, then plateaued. Restorative services were stable across the period. All other service areas have shown little change. The mix of services was also examined by age group over the period 1983 to 1998. This analysis produces a large number of tables (10), which are available on request.

Projecting dental visits per person per year

Dental visits per person per year have been increasing among dentate and edentulous persons. Between 1979 and 1995, demand from both groups had increased by approximately 50%.

The factors behind such increasing demand are complex. They may include:

- macro-economic factors such as community affluence, as reflected in growth in Gross Domestic Product;
- social factors like increasing educational attainment;
- consumer expectations about health and health services, including oral health and dental services;
- science and technology and their impact through the broadening of diagnostic tests and clinical interventions in health and dental services; and
- interactions between supply growth and demand.

The outcome appeared to be an increasing desire for a broader range of increasingly efficacious dental services. It is not possible to identify the specific role of any of these factors in the change in demand from 1979 to 1995. However, the key question is whether

these factors, or similar factors, are likely to influence demand in a similar manner over the next decade or so. Past trends in demand give a basis for exploring the likely trends in demand into the future. Therefore, demand has been projected on the basis of linear extrapolation of past trends.

Among the edentulous, the overall, rather than age-specific, demand trend has been extrapolated. The demand for dental visits is projected to increase to 0.76 visits per person per year for the edentulous population in 2010.

Demand among the dentate has been projected for specific age groups. For each of the 10 age groups, demand for dental visits was extrapolated through to 2010. Table 5 presents the demand for visits in 1995 and the projected demand for visits in 2010.

Table 5: Dental visits per dentate person per year in 1995 and projected for 2010

Age	Year	
	1995	2010
0-4	0.20	0.20
5-11	1.85	2.52
12-17	2.17	2.82
18-24	1.34	1.46
25-34	1.11	1.14
35-44	1.41	1.83
45-54	1.52	2.14
55-64	1.54	2.13
65-74	1.49	2.23
75+	1.40	2.08
Total (weighted)	1.50	1.86

The weighted number of dental visits per dentate person per year is projected to increase from 1.50 visits in 1995 to 1.86 visits in 2010, a 24.0% increase. The most salient features of the age-specific pattern of projected demand were:

- the continued increase in demand for visits among children and adolescents;
- the maintenance of the trough in demand among young adults; and
- the substantial growth in demand among dentate adults 35-44 years old and above.

Projecting dental services per visit

The past trend in the provision of dental services was used as the basis of projecting dental services at each dental visit. The overall number of services provided at each visit increased across 1983 to 1998. However, trends in individual age groups varied and these age-specific trends have been used to project the dental services per visit. Past trends in dental services were interpolated for a 1995 estimate and extrapolated through to 2010 so as to align the years for projections

of dental visits and services. Table 6 presents the dental services per visit in 1995 and projected dental services per visit in 2010.

Table 6: Dental services per visit in 1995 and projected for 2010

Age	Year	
	1995	2010
0-4	1.41	1.53
5-11	1.74	1.86
12-17	1.98	2.32
18-24	2.08	2.46
25-34	2.11	2.56
35-44	2.17	2.58
45-54	2.11	2.71
55-64	2.03	2.25
65-74	1.91	2.40
75+	1.91	2.18
Total (weighted)	2.05	2.38

Projecting the mix of services per dental visit

The age-specific trends in dental services per visit for each of the 10 service areas of dental services were used to project the demand for specific service areas. Past trends in each service area per visit were interpolated for a 1995 estimate and extrapolated through to 2010. Table 7 presents the number of services per visit for specific service areas for all age groups in 1995 and projected for 2010. Similar projections by the 10 age groups are available on request.

Table 7: Dental services per visit for specific service areas for all age groups in 1995 and projected for 2010

Service area	Year	
	1995	2010
Diagnostic	0.61	0.77
Preventive	0.35	0.51
Periodontic	0.02	0.02
Oral Surgery	0.08	0.07
Endodontic	0.12	0.19
Restorative	0.63	0.60
Crown & Bridge	0.07	0.09
Prosthetic	0.11	0.06
Orthodontic	0.02	0.04
General Misc.	0.04	0.05
Total (weighted)	2.05	2.38

Total demand for dental visits

Using 1995 as a baseline and 2010 as the end point for a projection period, the total demand for dental visits was calculated. Total demand for visits is the product of the dentate and edentulous population estimates for the 10 age groups multiplied by the estimated demand for dental visits.

The ABS population estimate for 1995 and the projection for 2010 using Series K are presented in Table 8 divided into the estimated number of dentate and edentulous persons in 1995 and projected for 2010 by 10 age groups.

Overall population growth is expected to be 15.9% between 1995 and 2010. Within the 10 age groups there are varied changes from slight reductions in the youngest age groups (0–4 and 5–11-year-olds), slight increases in young adults (18–24 and 25–34-year-olds) and more substantial increases in all other adult age groups. Overlaid on this basic change in population size and distribution is the decrease in edentulous and increase in dentate persons. The number of edentulous persons decreases by 32.8% and the number of dentate persons increases by 20.6%, considerably higher than the overall population growth from 1995 to 2010.

Table 8: Number of dentate and edentulous persons in 1995 and projection for 2010 by 10 age groups

Age	Year					
	1995			2010		
	Dentate	Edentulous	All	Dentate	Edentulous	All
0–4	1,299,524	–	1,299,524	1,166,476	–	1,166,476
5–11	1,812,304	–	1,812,304	1,754,192	–	1,754,192
12–17	1,530,981	–	1,530,981	1,643,568	–	1,643,568
18–24	1,935,905	8,165	1,944,070	2,028,351	1,827	2,030,178
25–34	2,812,533	27,836	2,840,369	2,900,463	11,064	2,911,527
35–44	2,665,534	90,964	2,756,498	3,004,085	29,425	3,033,510
45–54	2,003,442	220,628	2,224,070	2,902,728	75,345	2,978,073
55–64	1,180,680	331,849	1,512,529	2,316,676	217,981	2,534,657
65–74	815,331	467,039	1,282,370	1,277,752	308,926	1,586,678
75+	409,319	459,724	869,043	864,403	434,280	1,298,683
Total	16,465,553	1,606,205	18,071,758	19,858,694	1,078,848	20,937,542

These population estimates and projections to 2010 were then multiplied by the age-specific number of dental visits per person per year for dentate and edentulous persons. Total demand for dental visits is presented in Table 9.

Table 9: Total demand for dental visits in 1995 and projected for 2010 by 10 age groups

Age	Year	
	1995	2010
0–4	259,905	233,295
5–11	3,352,762	4,420,746
12–17	3,322,229	4,634,691
18–24	2,598,032	2,964,670
25–34	3,135,273	3,327,094
35–44	3,802,065	5,514,193
45–54	3,151,134	6,264,631
55–64	1,977,535	5,096,754
65–74	1,439,022	3,078,631
75+	793,714	2,130,795
Total	23,831,671	37,665,500

Demand for dental visits increases from 23.83 to 37.67 million visits from 1995 to 2010, a 58% increase. In all age groups older than 0–4-year-olds, demand increases. Increases are marginal from 25–34-year-olds and only modest for 18–24-year-olds. The largest increase is among 55–64-year-olds, a 158% increase.

The sensitivity of the projected demand for dental visits was tested by applying different assumptions for the continuation of the linear trend in demand among the 10 dentate age groups and all edentulous persons after 1995.

The total demand for dental visits in 2010 projected using the full extrapolation of the linear trend (100%), a 50% extrapolation and no continuation of the linear trend (0%) are presented in Table 10.

Table 10: Total demand for dental visits in 1995 and projected for 2010 under different assumptions

Age	Year			
	1995	2010		
		Percentage of past linear trend continued over 1995–2010		
		0%	50%	100%
0–4	259,905	233,295	233,295	233,295
5–11	3,352,762	3,306,197	3,863,472	4,420,746
12–17	3,322,229	3,583,404	4,109,048	4,634,691
18–24	2,598,032	2,622,862	2,793,766	2,964,670
25–34	3,135,273	3,194,392	3,260,743	3,327,094
35–44	3,802,065	4,263,892	4,889,043	5,514,193
45–54	3,151,134	4,357,620	5,311,125	6,264,631
55–64	1,977,535	3,668,531	4,382,643	5,096,754
65–74	1,439,022	2,096,823	2,587,727	3,078,631
75+	793,714	1,431,719	1,781,257	2,130,795
Total	23,831,671	28,758,738	33,212,119	37,665,500

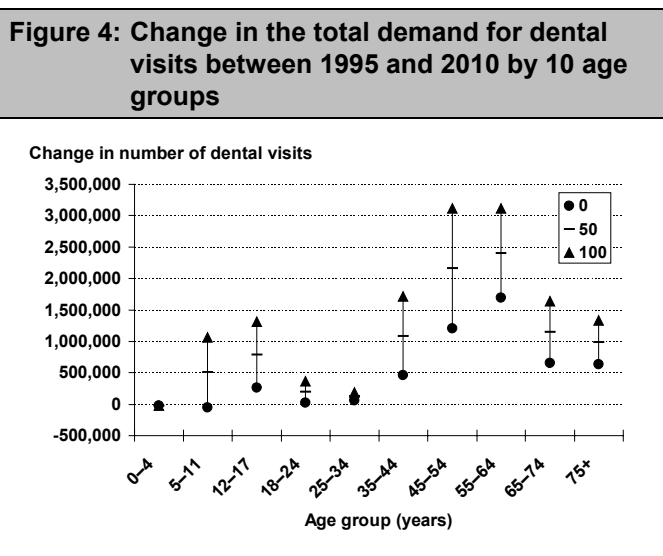
The projected demand for dental visits is highly sensitive to the assumption on the continuation of the linear trend in demand for dental visits per person per year. The full extrapolation of the linear trend (100%) projects the highest demand for dental visits, some 37.67 million, or a 58% increase, as presented in Tables 9 and 10. The assumption of no continuation of the linear trend (0%) projects the lowest demand for dental visits, some 28.76 million, or a 20.67% increase. Population growth contributes approximately two-thirds, while increased proportions of dentate adults contributes one-third of the 20.67% increase.

Increased demand among edentulous and dentate persons was sizeable between 1979 and 1995. While there is not a clear understanding of what factors have driven this increase in demand, many of the postulated factors, e.g. community affluence, educational attainment, consumer expectations, science and technology, can be expected to continue to influence demand for dental visits.

Therefore, the assumption of no continuation of the linear trend is unlikely. On the other hand, full continuation of the linear trend, without an understanding of all the factors which have influenced demand over the period 1979 to 1995 and their continued interplay through to 2010, produces a projection without a necessary element of caution. To project demand under these circumstances in a prudent manner, a 50% extrapolation of the linear trend is the preferred projection.

Table 10 shows that such an assumption projects demand increasing to 33.21 million visits, a 39.4% increase over 1995. The pattern of demand increases is similar, but slightly reduced from that described for the 100% extrapolation of the linear trend.

Figure 4 presents the change in the demand for dental visits between 1995 and 2010 by the 10 age groups under the three assumptions for the continuation of past linear trends. Variation in the age-specific population demand for dental visits is represented by the vertical bar, and the prudent 50% assumption for the extrapolation of the linear trend is captured by the mid-point of each vertical bar.



The key issues highlighted by these data are:

- the projected increase in total demand for dental visits is underpinned by population growth and the increase in dentate adult and older adults;
- increases are negligible among pre-school-aged children and young adults, and more substantial among schoolchildren, adolescents, middle-aged and older adults. The most substantial increases are projected for the baby-boomers, 45-54 and 55-64-year-olds.

Total demand for dental services

Using 1995 as a baseline and 2010 as the end point for a projection period, the total demand for dental

services was estimated. Demand for dental services is basically the product of the total demand for dental visits among edentulous persons and the 10 age groups of dentate persons by the number of services per visit in each service area. These are then summed within and across age groups.

Table 6 presented the demand for dental services per visit in 1995 and the projected demand for dental services per visit in 2010. The projection was based on the assumption of the full extrapolation of the linear trend observed between 1983 and 1998. As for the assumptions on the linear trend in demand for dental visits, a series of assumptions of 0%, 50% and 100% extrapolation of the linear trend was used to project dental services per visit. These are presented in Table 11.

Table 11: Total demand for dental services in 1995 and projected for 2010 by age group under different assumptions*

Age	Year			
	1995	2010		
		Percentage of past linear trend in services per visit continued over 1995-2010		
	0%	50%	100%	
0-4	365,198	328,202	342,445	357,098
5-11	5,826,873	6,754,589	6,963,877	7,190,181
12-17	6,565,188	8,283,269	8,873,971	9,513,171
18-24	5,407,415	5,941,220	6,410,402	6,879,583
25-34	6,630,340	7,095,690	7,702,934	8,335,115
35-44	8,256,568	10,931,715	11,747,590	12,602,183
45-54	6,655,144	11,716,736	13,053,125	14,389,513
55-64	4,020,820	8,884,475	9,381,751	9,879,027
65-74	2,744,097	5,223,815	5,711,455	6,199,096
75+	1,518,185	3,511,155	3,692,890	3,874,625
Total	47,989,826	68,670,865	73,880,440	79,219,593

* Based on the 50% continuation in linear trend in dental visits 1995-2010

The 23.8 million visits estimated in 1995 were associated with 48.0 million dental services. In 1995 these dental services were spread reasonably evenly across the 5-11 through to the 45-54-year-old age groups, with a slightly higher number in the 35-44-year-olds. The demand for dental services steadily fell across the 55-64, 65-74 and 75+ age groups. The projected demand for dental services in 2010 varies considerably under the different assumptions for a continuation of the trend toward more services per visit. With no continuation (0%) of the linear trend, some 68.7 million dental services were projected to be demanded in 2010. At full continuation of the linear trend (100%), the number of dental services projected to be demanded increases to 79.2 million, with the 50% continuation providing a mid-point projection of 73.9 million services, a 54.0% increase.

Total demand for dental services increases markedly in all adult age groups above 35 years old. The 35–44, 45–54 and 55–64-year-old age groups are projected to emerge as the high-demanding age groups for dental services. While demand for dental services among older Australians (75+) is projected to increase at the greatest rate, the absolute increase is considerably smaller than those projected for other adult age groups above 35 years old.

As the total demand for dental services was projected from the number of services in each service area demanded per visit, the demand for services within service areas can also be calculated. Table 12 presents the total demand for specific service areas for all age groups in 1995 and projected for 2010 under the assumption of a 50% continuation in linear trends in dental services per visit and 50% continuation in linear trends in dental visits per person per year.

Service area	Year	
	1995	2010
Diagnostic	15,242,905	23,506,376
Preventive	9,340,875	15,188,547
Periodontic	371,165	576,057
Oral Surgery	2,110,251	2,482,554
Endodontic	2,568,062	5,108,913
Restorative	13,551,606	19,427,442
Crown & Bridge	1,246,564	2,527,708
Prosthodontic	1,920,013	2,547,993
Orthodontic	703,259	1,114,060
General Misc.	935,126	1,400,789
Total	47,989,826	73,880,440

* Assumption of a 50% continuation in linear trends in demand for dental visits and 50% continuation in linear trends in demand for dental services per visit

Total demand for specific service areas in 1995 is dominated by Diagnostic, Preventive and Restorative service areas. Considerably lower numbers of services were demanded in Oral Surgery, Endodontic, Crown and Bridge and Prosthodontic service areas, and even less for General Miscellaneous, Orthodontic and Periodontic services.

The projected total demand for services indicates considerable increases in Diagnostic, Preventive, Endodontic, Restorative and Crown and Bridge service areas. Only small increases in the number of services is projected for Oral Surgery, Prosthodontic, Orthodontic and General Miscellaneous areas.

Several methodological issues need to be emphasised about these results for projected demand for specific service areas. First, these estimates and projections reflect service provision in general dental practice. While this is approximately 85% of all service provision in Australia, it specifically does not reflect

- the service pattern of the School Dental Services
- the service provision of specialist dentists.

While visits per person per year capture demand in these areas (and potentially among dental prosthetists), service patterns in these areas will be distinctly different. Hence, these data do not indicate the demand for 'special' or 'specialist' services.

Second, the apparent extremely low service provision in the Periodontic service area is in part explained by the categorisation of Scale and Clean services, minimum intervention periodontally-related services, as Preventive services.

Table 12 presents the total demand for specific service areas for all age groups in 1995 and projected for 2010. Similar projections by the 10 age groups are available on request.

Discussion

This report has described the change in demand for dental visits and services over the period of 1979 to 1995. The overall changes were substantial, and most age groups also showed substantial increases in demand. This report has not explored the factors behind the changes. While potential factors driving the changes are identified, their contribution, if any, to the time trends is unknown. Therefore, when attempting to look forward to future changes in demand across 1995 to 2010, the report has not been able to build a predictive model. Instead it has adopted a projection approach. Projections are built around a continuation of past time trends and are inherently uncertain. This has been clearly acknowledged by the presentation of a range of projections which assume between zero and full continuation of past trends.

This report does not seek to explore the relationship between supply and demand. However, it should be recognised that the two are clearly interrelated. Such interrelations vary from the concept of supply-induced demand to supply acting as a cap on demand expression and growth. While the former is a debated 'market' characteristic, the latter is likely to be a major feature of Australian dentistry over 1995 to 2010 as supply is expected to show only marginal growth (AHMAC, 2001).

Given potentially large increases in demand for dental visits and services, what types of response might be considered? Possible responses include:

- increasing supply in line with demand
- moderating demand growth in particular age groups or for particular services, among particular segments of the population
- some combination of the above.

Any response that seeks to moderate demand through oral health policy needs to be well informed about the burden and distribution of oral diseases and disorders, the patterns of demand for dental visits and services and their distribution across the population, the efficacy of dental services in producing oral health gains and improved oral health-related quality of life. A number of issues including equity and efficiency will influence judgments about the 'public good' of outcomes associated with different policy proposals. What appears necessary from the projections of demand is a purposeful effort to stimulate the gathering of information and discussion about directions to pursue.

Summary

Past trends in demand for dental visits and dental services were strong and clear. Demand for dental visits per person per year increased overall and particularly among school-aged children and adults aged 35 and over, whether edentulous or dentate. Demand for dental services per visit also increased substantially, and more evenly across all age groups. It was apparent that much of the demand for dental services lay in the areas of Diagnostic, Preventive and Endodontic services.

Population growth and ageing, plus the increased percentage of adults who are dentate, will continue to drive total demand higher, a 21% increase between 1995 and 2010.

Any continuation in the past trends in demand for dental visits per person per year or dental services per visit is uncertain. However, continuation in either leads to even higher projections of population demand for dental visits. For instance, if both continue at 50% of the past linear trend, then total demand for dental visits rises by 39.4% and total demand for dental services by 54.0%.

Disproportionate amounts of that increase in total demand for dental visits lies with adults 35 years old and over, particularly those aged 35-44 and 45-54 years old, and in total demand for Diagnostic, Preventive and Restorative service areas.

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